Aimed at veterinary surgeons, students, professors and professionals in this field.

TECHNICAL SPECIFICATIONS

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This atlas offers a detailed and systematic approach to the post-mortem examination of farmed poultry. The first chapter, describes the organs from the skin to the nervous system, presents a simple post-mortem technique, which explains how to examine each organ and body system, and illustrates what they look like when healthy.

The second chapter describes the avian diseases that are usually encountered at the slaughterhouse with numerous images, following the same organisation as the first chapter.

Finally, the third chapter outlines a methodical approach for sampling during the post-mortem examination for subsequent diagnostic analysis.

With over 200 images, this book will ensure that post-mortem examination of poultry will produce maximal diagnostic results.

More information
1. Post-mortem techniques in farmed poultry
   Aspects to consider first
   Characteristics and steps of the autopsy technique
   External examination and sample taking in the live bird
   Preparation of the carcase and opening of the coelomic cavity
   Removing the internal organs
   Examination and inspection of the internal organs
   Examination of the head: evaluation of the nasal cavity and the brain
   Examination of the locomotor apparatus: evaluation of nerves, joints, bones and muscles

2. Macroscopic inspection of the organs
   Aspects to consider first
   Skin and subcutaneous tissue
   Respiratory system
   Digestive system
   Cardiovascular system
   Lymphohaematopoietic system
   Urogenital system
   Locomotor apparatus
   Nervous system

3. Sampling and other general considerations
   Practical aspects to consider
   Histopathology
   Microbiology/bacteriology
   Virology
   Molecular biology
   Serology
   Parasitology
   Toxicology
Extraction of the internal organs

The coelomic cavity organs are removed together. To achieve this, a cut is made in both commissures of the beak (fig. 21) and in both sides of the hyoid bone, exposing the oral cavity (fig. 22). An incision is made in the soft palate region (fig. 23) and the trachea and the oesophagus through to the crop are cut and removed together by gentle traction (fig. 24). Continue cutting until reaching the heart, and then again with gentle traction and helped with the tips of the scissors, separate the lungs from the dorsal region of the coelomic cavity (fig. 25).

The liver and the gastrointestinal tract are extracted whole together with these organs. Simply pull gently with the hands towards the caudal region, where the rectum remains attached to the animal in the cloacal region (fig. 26). The bursa of Fabricius is located in this cloacal region, and it should be extracted with the rest of the organs from the coelomic cavity. This is a small, round lymphoid organ located in the dorsal part of the cloaca (fig. 27). Like the thymus, this organ is not present throughout the animal’s life, but involutes between 14 and 20 weeks. Once the bursa is localized, a U-shaped incision is cut around it, so that most of the organs of the coelomic cavity have been removed (fig. 27).

In the case of adult hens, the reproductive system is also found in the coelomic cavity (fig. 28) which is extracted along with all the organs, as is the digestive system (fig. 29). Only the genitourinary system will remain in the interior of the coelomic cavity, and the reproductive system (testis and oviduct) in the case of young birds (figs. 30a and 30b). Although the kidneys are examined in situ, it may be necessary to extract them for sampling. To extract the kidneys, which are totally inserted into the pelvis bones, the best system is to exert a slight pull from the medial and caudal region of the kidneys with forceps, and with the tip of the scissors to help extraction (fig. 31).

Unlike mammals, birds do not have two cavities, thoracic and abdominal, but just one internal cavity called the coelomic cavity, where most of the vital organs are found. To open the coelomic cavity, make a cut in the area located below the breast using a pair of scissors (fig. 16). Next, make two small lateral cuts until reaching the ribs, and with the help of the bone cutting forceps cut the ribs (in the cranial direction) (fig. 17), the clavicle and coracoids on both sides to expose the organs of the coelomic cavity (figs. 18 and 19). This is the precise moment to assess the presence of diverse exudates and the condition of the air sacs, as on the removal of the organs these will most likely break. The air sacs in a recently slaughtered animal, must be transparent, smooth and shiny (fig. 20).
Microbiology/bacteriology

Histopathological studies are extremely useful tools:
1. To detect bacterial or fungal causative agent from the clinical profile.
2. To perform an antibiogram, which helps to identify the most appropriate means to isolate them. For example, a specific request should be made to detect Salmonella, as it is a bacterium which requires a specific culture medium for its isolation.

Type of sample

Microbiological study samples may be collected using a swab, preferably with transport medium (fig. 3) or by extracting a portion of an organ which is introduced into a sterile flask in the maximum sterile conditions possible (fig. 4).

Tissues or organs for sampling

- Generally, the organ or tissue of choice is the one where macroscopic lesions indicative of bacterial infection are observed.
- In cases where sepsicaemia is suspected, even though lesions are not observable, it is advisable to sample at least two or three tissues from each bird, in order to confirm the presence of bacteria in various tissues.

Sample preservation

Since some bacteria do not hold up well to freezing, it is best to keep these samples refrigerated. When taking swabs, the use of general transport medium is recommended as it retains bacterial viability for later identification.

Pathologies of choice

In all bacterial or fungal aetiologies in which the microorganism is easily isolated.

Virology

The objective of virological studies is to isolate the virus. In contrast to most bacteria or fungi, virus isolation is costly both in time and expense; many passes are often required to isolate the virus. Therefore, few laboratories perform this study as a routine test. These negative aspects have led to the development of molecular diagnostic techniques in recent years, which allow viruses to be detected more rapidly.

Despite this, in cases where serotype or protectotype studies are required, virus isolation is still necessary.

Type of sample

As in bacteriological studies, the collection of samples for virus isolation can be performed from a swab or a tissue sample.

Tissues or organs for sampling

Samples will be taken from tissues where the virus replicates, which generally coincide with the tissues in which the lesions appear. In the case of intestinal viruses, isolation can be performed from the faeces or intestinal contents.

Sample preservation

Freezing is the best way to preserve viral viability. However, in some cases, standard freezing at -20°C is not enough. For this reason, it is best to submit samples refrigerated and by courier.

Molecular biology

Histopathological studies are extremely useful tools:
1. To detect bacterial, viral or parasitic pathogens, such as Mycoplasma synoviae, which in general are costly to isolate.
2. To genotype the pathogens. In many cases the molecular tests allow the causative agent to only be detected but also to be characterised better: by distinguishing different types of strains or distinguishing between field strains and vaccine strains. As mentioned earlier, the molecular characterisation of the Gumboro virus detects and differentiates the strain of the vaccine virus from the field strain.
3. Quantification of pathogens. Some techniques determine the exact copy number of genomes present in a sample. Although currently these techniques are mostly used on an experimental level, in the future they might be useful in diagnosing certain pathogens.

Type of sample

The collection of samples for molecular studies is obtained by a swab or a portion of tissue. It should be remembered, that in this study the swabs must be dry, without any transport media (fig. 5). Also it may be useful to obtain FTA-card spots in some pathogens (for example, in the case of gumboro virus). It has been demonstrated that these cards inactivate the infectious agent but preserve its genetic material, and therefore may be used in these techniques. However, it must be remembered that it is not possible to isolate the microorganism from these cards at a later date.

Tissues or organs for sampling

The decision whether to use tissue with pathogen replication or stationary pathogen tissue will depend upon each pathogen.
MACROSCOPIC EVALUATION OF THE ORGANS
CARDIOVASCULAR SYSTEM

**Pericarditis**: it is an inflammation of the serous membranes surrounding the heart and forming the pericardium sac. This lesion is characterized by the presence of exudate, usually fibrinous or fibrinopurulent, in the pericardial cavity or on the surface of the visceral pericardium (fig. 90). This lesion is frequent in animals suffering from septicaemia, usually due to *Escherichia coli*. It is normal to observe pericarditis and airsacculitis (polyserositis) in addition to pericarditis (fig. 91).

**Neoplasm of the myocardium**: it is relatively rare, but the most common tumour is lymphoma, seen as white areas or nodules in the myocardium (fig. 92) associated to Marek’s disease virus.

**Aortic rupture in turkeys**: it is an uncommon lesion but can lead to elevated mortality losses in male turkeys. The rupture of the aorta and subsequent massive haemorrhage in the coelomic cavity often originates from an aneurysm which forms in the abdominal aorta and produces the bird’s death.

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**Lymphohaematopoietic system**

Included in this section are the lesions affecting the thymus, spleen and bursa of Fabricius. The most important characteristics to be assessed in these organs are the **size and coloration**. It is important to note that, as discussed above, both the thymus and the bursa of Fabricius are organs that regress with age. Therefore the size, which is one of the most important parameters to grossly evaluate these organs, varies considerably depending on the age of the bird.

### Thymus

The principal gross lesion in this organ is a notable decrease in size known as **thymic atrophy** (fig. 93). This is a significant lesion in broilers and may have multiple causes, but the most common cause is an infection by avian infectious anaemia virus. Usually this disease causes pale pink or yellowish lesions in the affected animal’s bone marrow (fig. 94). Haemorrhaging, normally observed due to the presence of petechiae, is often found in the thymus although it is nonspecific.

### Spleen

Like the thymus, a change in size is the most common gross alteration to be observed. An increase in the relative size of the spleen, known as **splenomegaly**, is normal as a primary response to circulating antigen. This size increase is usually accompanied by milky white spots seen both on the organ surface as well as at the section (fig. 95). This lesion is often observed in animals suffering from septicaemia, mainly due to *Escherichia coli*.

Inflammation of the spleen, known as **splenitis**, is quite rare. It is seen in cases of tuberculosis in which the spleen has multiple white nodules that correspond to granulomas (fig. 96).

Finally, the spleen may be enlarged due to the presence of lymphoma in animals affected by Marek’s disease or avian leukosis (fig. 97).
The main changes to be observed in the female reproductive system are:

- **Ovarian regression:** it is associated with the hen reaching the end of the laying cycle or phase, or with various factors such as nutritional changes, infectious diseases, toxicity, hormonal manipulations or environmental factors which lead to cessation of ovulation. This process is called ovarian regression or atrophy (fig. 109). In the affected ovary, new follicles will not develop and those present will suffer follicular atresia. **Ovarian follicular atresia** is the process whereby an ovule which has failed to ovulate, disappears and is reabsorbed. These follicles lose the characteristic shape and stiffness of developing follicles. The yolk they contain becomes more watery, less dense, and eventually are reabsorbed into the bloodstream (fig. 110). This may be due to a physiological process since not all developing ova arrive to ovulation, or, due to a pathological process that induces ovarian regression.

- **Persistent right oviduct:** in some cases the right-side ovary and oviduct may not disappear but accumulate clear liquid which forms a cyst on the right side of the cloaca. This persistent or cystic right oviduct is observed in birds that have not yet reached sexual maturity (fig. 111), as well as in adult birds (figs. 112 and 113).

- **Oviduct hypoplasia:** is an abnormality characterised by an incomplete development of the oviduct. Macroscopically, a shorter oviduct is seen, and also in some cases, the end of the lumen becomes occluded (figs. 114 and 115). This may be due to genetic causes or early infections before the bird reaches sexual maturity (e.g., infectious bronchitis virus).